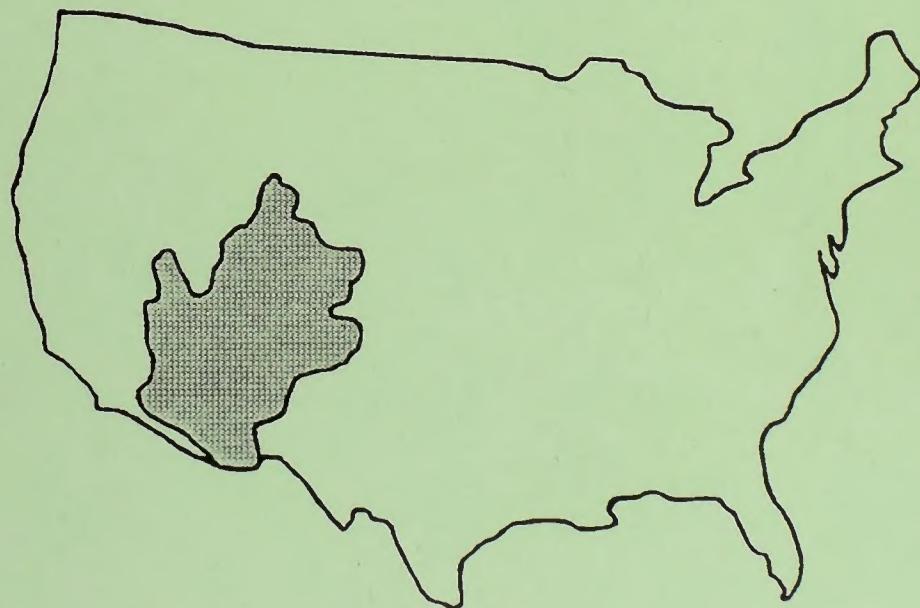




1993 Joint Evaluation of the Salinity Control Program in the Colorado River Basin



United States Department of the Interior
Bureau of Reclamation
Bureau of Land Management
United States Department of Agriculture
Soil Conservation Service
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Prepared by the

United States Department of the Interior
Bureau of Reclamation
Bureau of Land Management

and the

United States Department of Agriculture
Soil Conservation Service

in cooperation with the
U.S. Geological Survey
U.S. Fish and Wildlife Service
Environmental Protection Agency
Agricultural Stabilization and Conservation Service
Agricultural Research Service
Cooperative Extension Service
Cooperative State Research Service

January 1994

Disclaimer

Nothing in this report is intended to interpret the provisions of the Colorado River Compact (45 Stat. 1057); the Upper Colorado River Basin Compact (63 Stat. 31); the Water Treaty of 1944 with the United Mexican States (Treaty Series 994, 59 Stat. 1219); the United States/Mexico agreement in Minute No. 242 of August 30, 1973 (Treaty Series 7708; 24 UST 1968); the decree entered by the Supreme Court of the United States in *Arizona v. California*,

et al. (376 U.S. 340); the Boulder Canyon Project Act (45 Stat. 1057); the Boulder Canyon Project Adjustment Act (54 Stat. 774; 43 U.S.C. 618a); the Colorado River Storage Project Act (70 Stat. 105; 43 U.S.C. 620); the Colorado River Basin Project Act (82 Stat. 885; 43 U.S.C. 1501); the Colorado River Basin Salinity Control Act (88 Stat. 266; 43 U.S.C. 1951); or the Hoover Power Plant Act of 1984 (98 Stat. 1333).

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Overview

The salinity control program in the Colorado River Basin was authorized by the Colorado River Basin Salinity Control Act of 1974 (Public Law 93-320), as amended by Public Law 98-569.

As required by the Clean Water Act (Public Law 92-500), existing numeric salinity criteria and the plan for implementing the salinity control program must be reviewed every 3 years. The last review was documented in *Report on the 1993 Review, Water Quality Standards for Salinity, Colorado River System*, October 1993. The salinity control plan identified in that review satisfies salt load reduction objectives and program goals by maintaining average total dissolved solids (TDS) at Imperial Dam, below Parker Dam, and below Hoover Dam at or below 879, 747, and 723 milligrams per liter (mg/L), respectively, while the Basin States continue to develop their compact-apportioned waters. The 1993 salinity control plan is the officially adopted plan.

This 1993 joint evaluation report, prepared by the U.S. Department of the Interior and the U.S. Department of Agriculture (USDA), describes the salinity control plan identified in the 1993 review.

This report also outlines the coordination efforts needed to effectively implement the salinity control program and describes major program activities through fiscal year 1993. Figure 1 shows the locations of the Department of the Interior and Department of Agriculture salinity control units. Table 1 shows the salinity control plan.

The salinity control plan will remove about 1.375 million tons of salt annually from the Colorado River system by the year 2015 at a remaining cost of approximately \$480 million. As of January 1993, 261,700 tons of salt annually were being removed.

Public Law 93-320 and its amendment require that a percentage of the Federal cost of the salinity control program be repaid from the Upper and Lower Basin water development funds with revenue generated from the sale of hydropower. Repayment analysis of the Lower Colorado River Basin Development (LCRBD) Fund prepared for this evaluation shows that sufficient funds are available to cover appropriate costs of the salinity control plan. The LCRBD Fund can repay its share of the costs with an inflation rate of 6.4 percent.

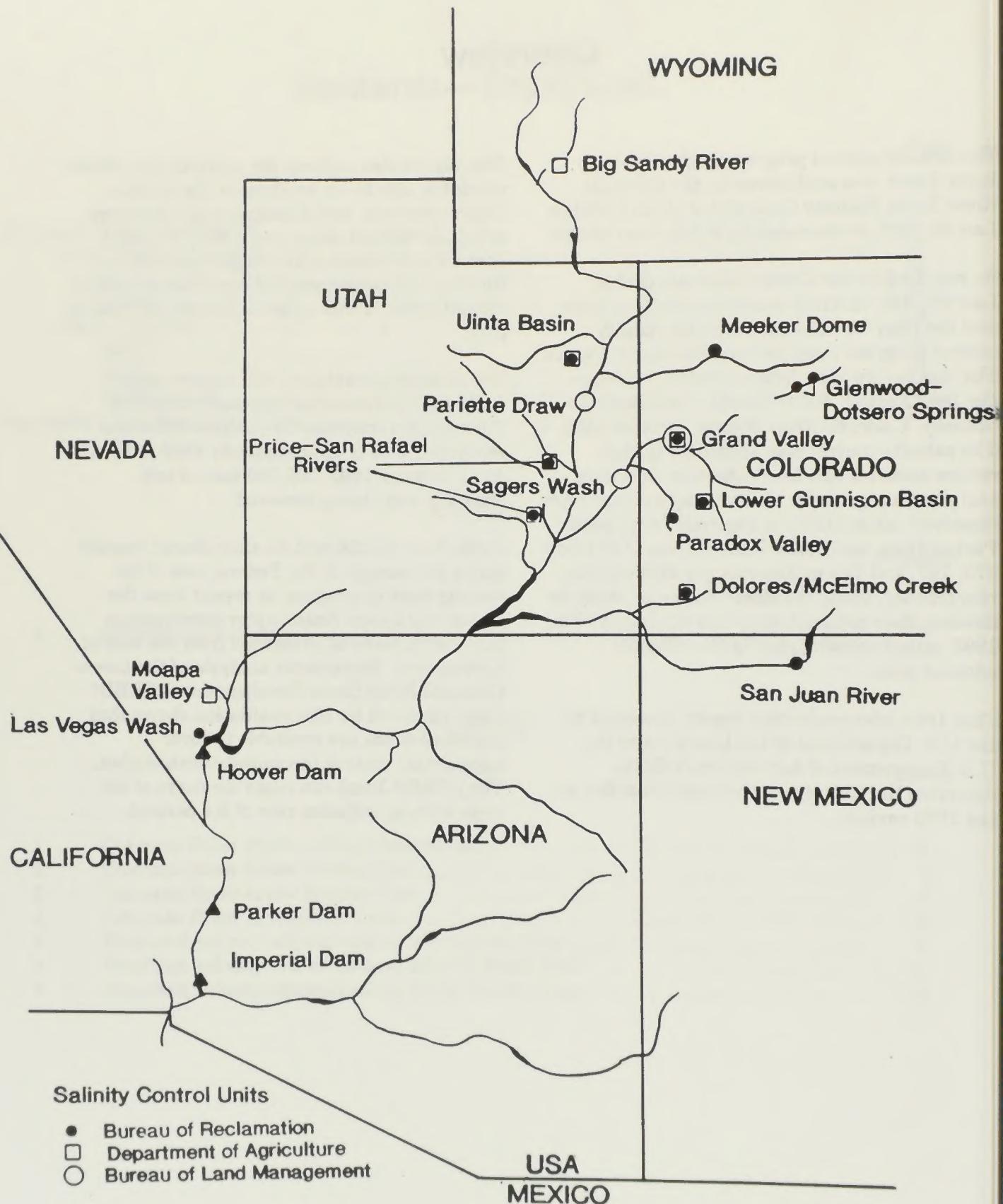


Figure 1.—Colorado River Basin salinity control units.

Table 1.—Salinity control plan

Unit	Begin implementation	Projected date complete	Tons/yr removed Jan. 1993	Projected salt removed (tons/yr) project completion	Cost effectiveness (\$/ton)
Meeker Dome (USBR)	Complete	1983	48,000	48,000	14
Grand Valley Stage One (USBR)	Complete	1984	21,900	21,900	121
Las Vegas Wash Pittman (USBR)	Complete	1985	3,800	3,800	44
Grand Valley (USDA)	1979	2010	56,600	163,000	27
Uinta Basin (USDA)	1980	2010	55,500	106,800	80
Nonpoint Sources (BLM)	1983	2015	2,800	41,000	
Well Plugging (BLM)	1984	2015	8,000	14,000	
Grand Valley Stage Two (USBR)	1985	1998	25,600	115,600	113
Paradox Valley (USBR)	1988	2001	0	180,000	49
Big Sandy River (USDA)	1988	2003	12,500	52,900	27
Lower Gunnison (USDA)	1989	2016	24,700	280,500	70
McElmo Creek (USDA)	1990	2009	2,300	38,000	83
Lower Gunnison Winter Water	1991	1994	0	74,000	38
Dolores Project (USBR)	1991	1995	0	23,000	84
Moapa Valley (USDA)	1994	2006	0	18,700	38
Lower Gunnison—Laterals (USBR)	1994	2007	0	60,000	70
¹ Uinta Basin I (USBR)		2004	0	25,500	88
¹ San Juan—Hammond (USBR)		2007	0	28,000	42
¹ Price-San Rafael (USBR/USDA)		2021	0	161,000	39
Total			261,700	1,455,700	

¹Units that have been investigated, and are in the Salinity Control Plan of Implementation, but require congressional authorization. The "Begin Implementation" date will be determined upon authorization and funding.

A—Units under consideration and/or investigation, not currently in the plan—additional information is needed:

Glenwood Springs Desalination (USBR/private)~
Sinbad Valley (USBR/BLM)
Lower Virgin River (USBR)~

San Juan Hogback (USDA)
San Juan Hogback (USBR)~

~Units needing congressional authorization.

B—Examples of units investigated, but currently not being given further consideration:

Dirty Devil River (USBR)
Palo Verde Irrigation District (USBR/USDA)
Grand Valley II Balance (USBR)
San Juan—Hammond Portion (USDA)
La Verkin Springs (USBR)
Saline water use and disposal

Mancos Valley (USDA)
Lower Gunnison Stage I Balance (USBR)
Lower Gunnison North Fork (USBR)
Virgin Valley (USDA)
Las Vegas Wash—excluding Pittman (USBR)

Program Coordination

Federal and State coordination is critical for effective implementation of the salinity control program. Program coordination among the U.S. Department of Agriculture (USDA), the Bureau of Reclamation (Reclamation), and the Bureau of Land Management (BLM) occurs through agency interaction at the field level and through the USDA, Reclamation, and BLM salinity control coordinators. Several committees coordinate actions among participating Federal and State interests.

Interagency Salinity Control Coordinating Committee

The Interagency Salinity Control Coordinating Committee (ISCCC) facilitates communication about salinity control program issues among Federal agencies. The ISCCC met twice in 1993 to address Federal interagency policy issues.

Technical Policy Coordinating Committee

Technical coordination among agencies is accomplished through the Technical Policy Coordinating Committee (TPCC). The TPCC was formed to improve the coordination of salinity control investigations and the construction of salinity control units. Representatives from Reclamation, BLM, Soil Conservation Service (SCS), U.S. Fish and Wildlife Service (FWS), U.S. Geological Survey (USGS), Environmental Protection Agency (EPA), and the Colorado River Basin Salinity Control Forum Work Group participate in TPCC meetings. Several subcommittees met during the year to address specific issues.

USDA National Salinity Control Coordinating Committee

The USDA National Salinity Control Coordinating Committee is responsible for coordinating USDA program activities at the national level. This committee is comprised of representatives from the Agricultural Research Service (ARS), Agricultural Stabilization and Conservation Service (ASCS), Cooperative State Research Service (CSRS), the Extension Service (ES), and the SCS. Reclamation, BLM, and EPA also participate in committee meetings.

This committee met regularly in 1993 and took action on a number of policies, procedures, and fund management issues to ensure effective coordination of USDA agency activities.

Colorado River Basin Salinity Control Forum

The Colorado River Basin Salinity Control Forum (Forum) was established in 1973 to foster interstate cooperation and to develop water quality standards for salinity in the Colorado River Basin. The Forum is comprised of up to three representatives from each of the seven Colorado River Basin States. Federal agencies are represented on the Colorado River Basin Salinity Control Forum Work Group and serve as advisors to the Forum.

The Forum met in Grand Junction, Colorado, on April 28, 1993, and in Phoenix, Arizona, on October 26 and 27, 1993. The Forum Work Group met five times in 1993.

Program Evaluation

Background

Colorado River salinity concentrations fluctuated widely over the period 1941 to 1993. Generally, salinity concentrations decrease in periods of high flows and increase in periods of low flows. Although high flows in the period 1983 to 1987 temporarily lowered salinity levels in the system, levels currently are rising.

Figures 2, 3, and 4 show the annual flows of the Colorado River below Parker Dam, below Hoover Dam, and at Imperial Dam, respectively, and the corresponding annual salinity concentrations.

Figures 5, 6, and 7 provide a historical perspective, the numeric criterion, and the projections of salinity below Parker Dam, below Hoover Dam, and at Imperial Dam, respectively, without further salinity control measures.

Without the recommended controls, the salinity at all three stations is expected to increase significantly over the next 20 years. About 1.375 million tons of salt per year must be removed from the Colorado River system by the year 2015 to maintain TDS levels at the numeric criterion at all three stations. Projects that control about 262,000 tons per year have been completed.

The following salinity control projects, or portions of them, are removing the approximately 262,000 tons of salt annually from the river system: Meeker Dome, Las Vegas Wash, Grand Valley, Uinta Basin, Big Sandy River, Lower Gunnison, and McElmo Creek Units as well as BLM well plugging. (See table 1.)

Projections of future salinity levels in the Colorado River (shown in figures 5, 6, and 7) were derived from 78 sequences of historically based hydrology. Depletion projections were developed jointly by Reclamation and the Forum.

Moderate variations in the salinity levels—in impoundments like Lake Powell and Lake Mead and at Imperial Dam—can be attributed to several factors, including water demands,

weather, and salinity control measures. However, salinity levels at Hoover Dam and below are very sensitive to the following two factors:

- Accumulated reservoir inflow and resulting high reservoir storage.—Whenever reservoir inflow is significantly greater than normal, dilution generally occurs within the large reservoirs of Lakes Powell and Mead.
- Reservoir discharges.—Whenever riverflows are low, salinity concentrations are high; whenever riverflows are high, salinity concentrations are low.

Very rapid changes in salinity levels can be observed when these two conditions exist at the same time. For example, when: (1) previous reservoir inflows have been high for several seasons and (2) reservoir discharge has been above average, very low salinity levels can be expected, as in 1986 (less than 600 mg/L). Conversely, high salinity levels can be expected when reservoir inflow has been low for several seasons and the reservoir discharge has been at a minimum.

Because of the vast water storage behind Glen Canyon and Hoover Dams, Upper Basin salinity control projects implemented in any given year do not begin to reduce salinity levels at Imperial Dam until many years later. This time lag is recognized when scheduling project implementation to achieve desired results.

The Program

The salinity control plan is designed to maintain the average salinity concentration of the Colorado River at or below the numeric criterion at the three stations (Hoover, Parker, and Imperial Dams) without impairing the development and use of compact-apportioned waters in the Colorado River Basin. The Basin-wide salinity control program is designed

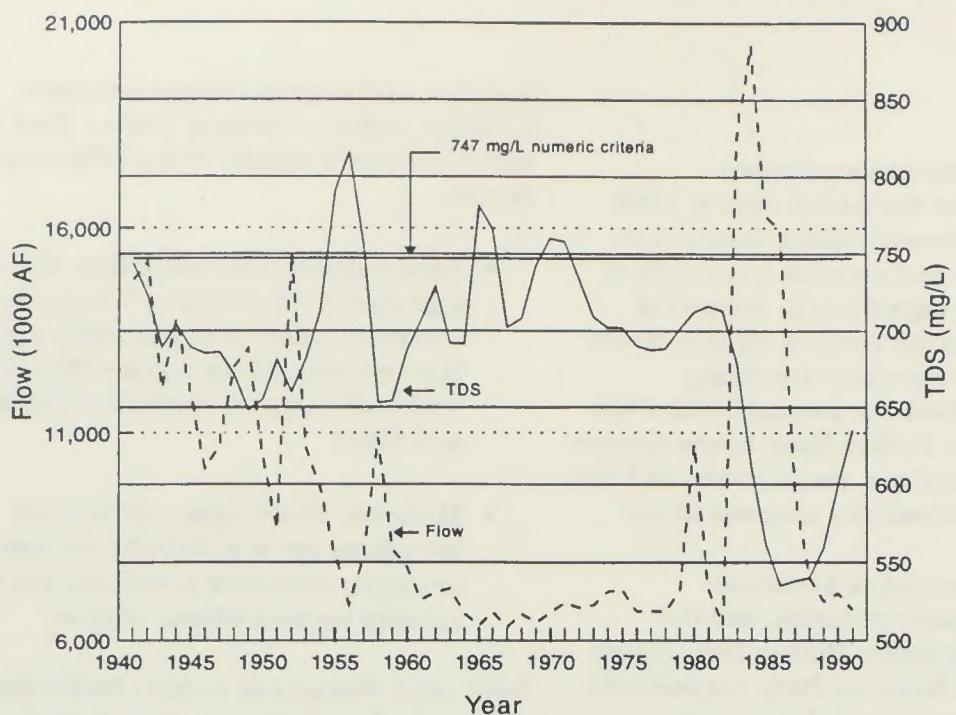


Figure 2.—Colorado River below Parker Dam.

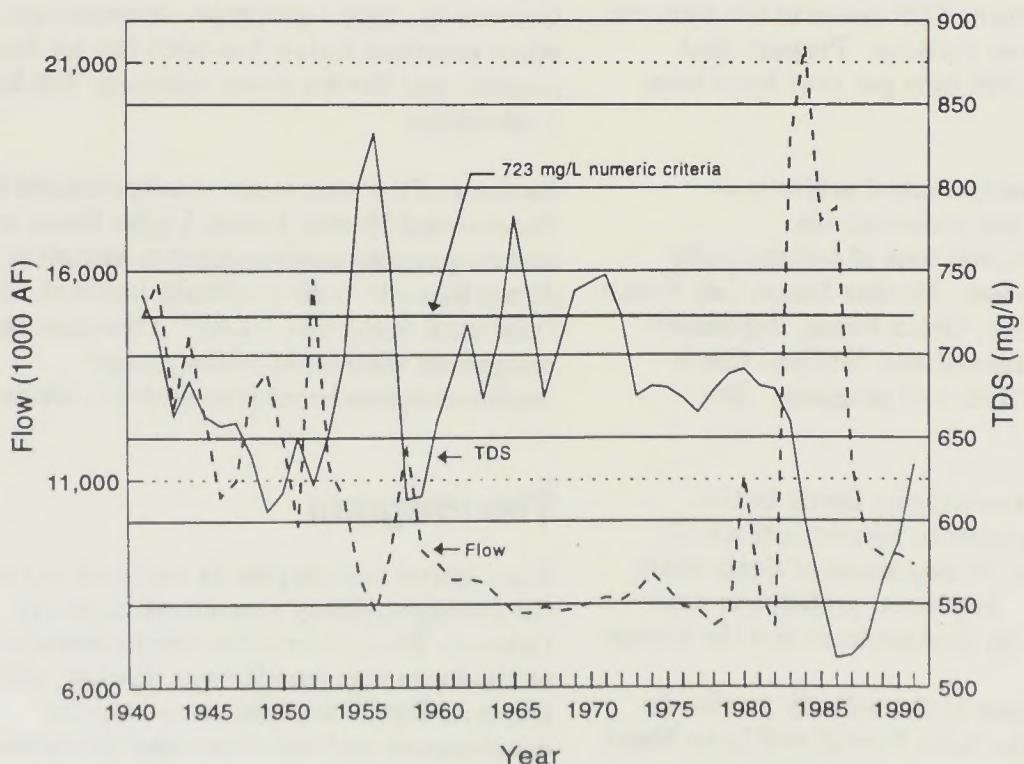


Figure 3.—Colorado River below Hoover Dam.

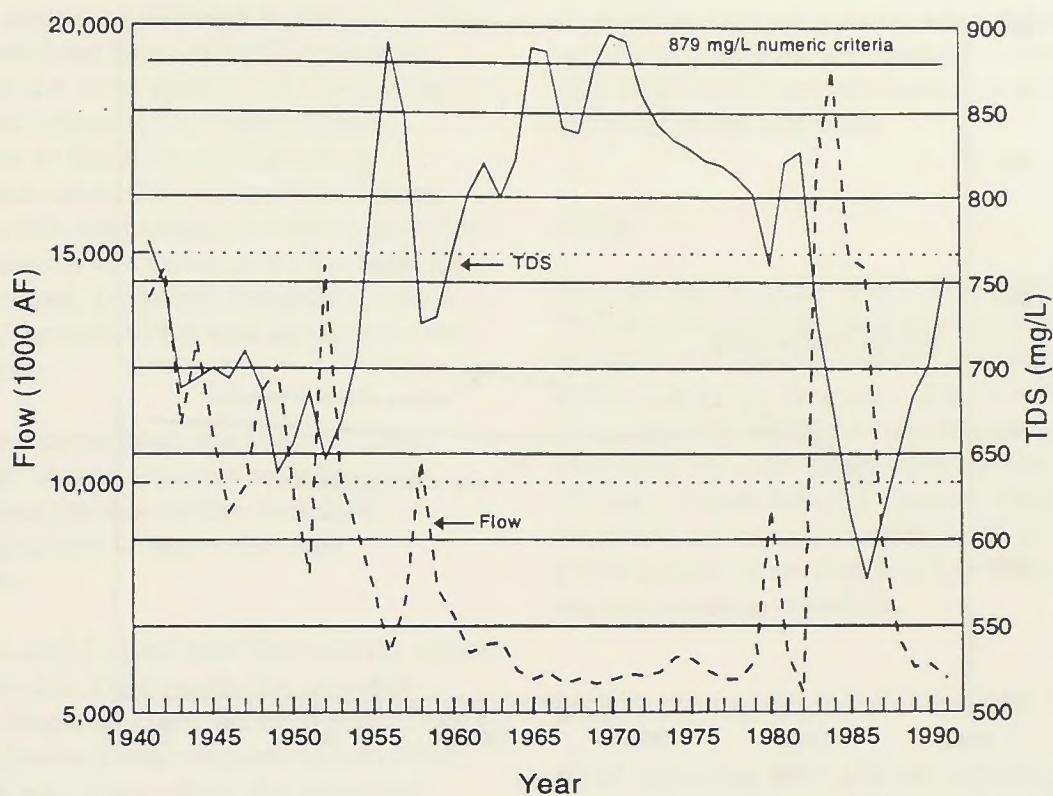


Figure 4.—Colorado River at Imperial Dam.

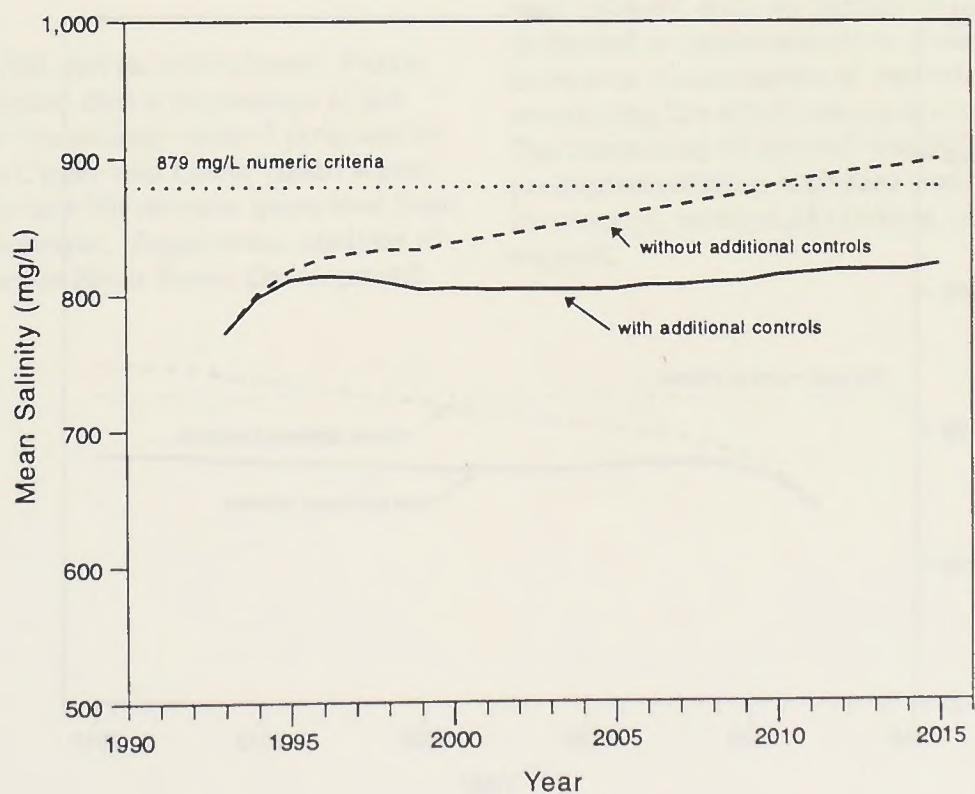


Figure 5.—Projected salinity concentrations at Imperial Dam.

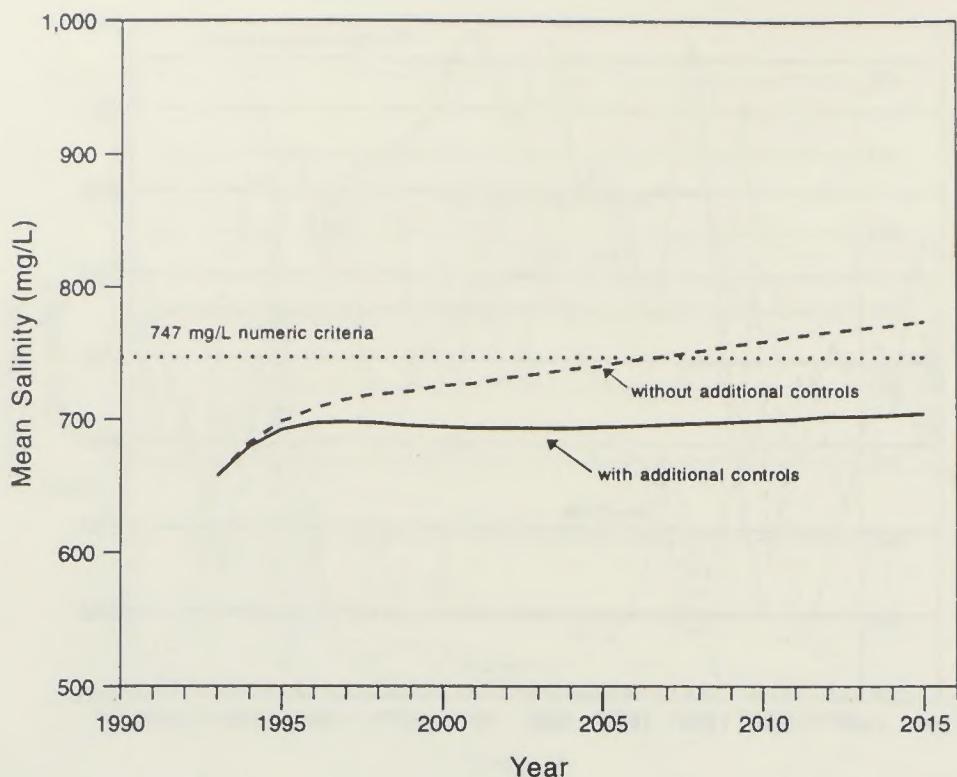


Figure 6.—Projected salinity concentrations below Parker Dam.

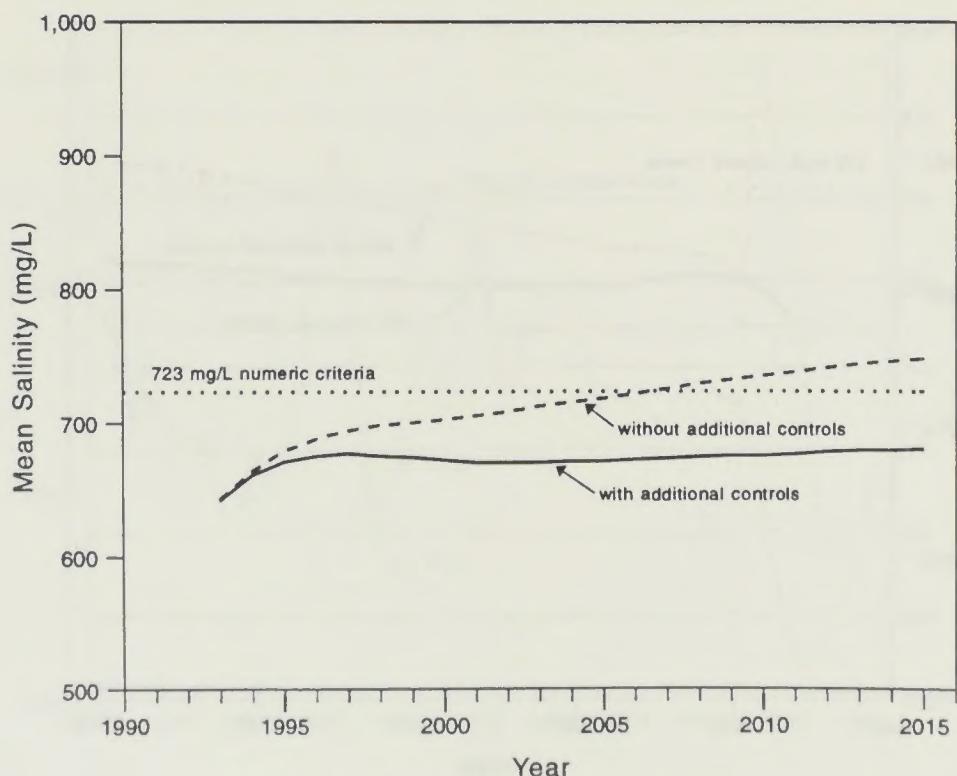


Figure 7.—Projected salinity concentrations below Hoover Dam.

to offset salinity increases caused by man's development of the States' compact-apportioned waters and makes no attempt to offset salinity increases resulting from natural hydrologic variations of the river system. Salinity control is accomplished primarily by reducing salt contributions to the river from existing upstream sources and by minimizing future increases in salt load caused by man's activities. Control measures are selected on the basis of cost effectiveness, technical feasibility, social and political acceptability, and environmental considerations.

The salinity control plan will remove about 1.375 million tons of salt annually from the Colorado River system by the year 2015 at a remaining cost of approximately \$480 million.

Figures 5, 6, and 7 show how the salinity control plan identified in 1993 meets the numeric criterion at Imperial Dam, below Parker Dam, and below Hoover Dam, respectively, in 2015. Figures 5, 6, and 7 also show the projected salinity at Imperial Dam with and without further controls to the year 2015.

Funding

Public Law 93-320 and its amendment, Public Law 98-569, require that a percentage of the Federal cost for the salinity control program be repaid from the Upper and Lower Basin water development funds with revenue generated from the sale of hydropower. Repayment analysis of the Lower Colorado River Basin Development

(LCRBD) Fund prepared for the 1993 water quality standards review, and this evaluation shows that sufficient funds are available to cover appropriate costs of the salinity control plan. The 1993 repayment analysis spreadsheets are included in the appendix.

USDA

The current funding of \$13.783 million for the USDA portion of the plan greatly limits implementation and hinders bringing new projects into the program. About 867 farmers are currently waiting to participate in the program. In accordance with the Joint Agency Colorado River Salinity Control Budget Proposal, an annual funding level of \$15.9 million is needed to achieve the USDA implementation schedule.

BLM

BLM expended \$866,000 on salinity control efforts in the Basin. Additional funding is necessary for BLM to implement the salinity control efforts envisioned in the 1993 Salinity Control Plan of Implementation, 1993 Review. Approximately \$19 million is needed for fiscal year 1994-97, with 60 percent of the funding dedicated to implementation of control measures, maintenance of controls, and monitoring the effectiveness of control practices. The remaining 40 percent would fund preimplementation activities such as inventories, watershed ranking, planning, and support.

Program Status

This section describes 1993 salinity control activities.

Big Sandy River Unit, Wyoming

The Big Sandy River Unit is located in southwestern Wyoming. USDA identified a cost-effective onfarm program to remove 52,900 tons. Reclamation did not identify a cost-effective off-farm salinity control program.

USDA

Implementation has been underway in this unit since 1988. During 1993, 16 new salinity control contracts were approved for a total of 63 salinity control contracts with farmers. There are 14 applications pending approval. The application of salinity reduction and wildlife habitat replacement practices has accelerated as new contracts are approved. In this area, farmers are converting from surface flood irrigation to primarily low-pressure center pivot irrigation systems for salinity control.

Twenty-one center pivot systems were installed by farmers in 1993. Information and education activities have been underway on alfalfa variety trials and no-till methods to establish alfalfa.

Reclamation

Reclamation's planning activities for this unit will be finished after one deep aquifer monitoring well is plugged. Because the monitoring well is on BLM lands, Reclamation and BLM have signed a cooperative agreement for BLM to oversee the plugging of the well. At the direction of BLM, geophysics testing is scheduled for completion in the fall of 1993. If appropriate, the well will be plugged with grout early in 1994.

McElmo Creek Unit—Dolores Project, Colorado

The McElmo Creek Basin is located in southwestern Colorado and covers about 720 square miles. Early studies in the area showed that salt loading results from irrigation and diffuse sources, with irrigation as the main contributor. Reclamation and USDA have identified cost-effective programs to reduce salt loading from the area by 61,000 tons per year.

Reclamation

Reach 1 and 2 of the Towaoc Canal have been completed. Work is now underway to complete the Rocky Ford Laterals, which deliver water from the Towaoc Canal. Contracts for lining three sections of the Lone Pine Lateral and the one section of the Upper Hermana Lateral have been awarded and are under construction. The unit is scheduled to be completed in 1994.

USDA

Implementation was initiated in this unit in 1990. In 1993, 49 new contracts were approved for a total of 140 contracts. There are approximately 159 applications pending approval.

Application of salinity reduction and wildlife habitat replacement practices is well underway in this area. The dominant practices are side-roll sprinkler systems and underground pipelines to replace many of the inefficient surface flood irrigation systems on the undulating fields. Gated pipelines, surge valves, and other irrigation systems are also being applied to improve surface irrigation systems. During 1993, Reclamation installed piped laterals to replace the Rocky Ford Lateral. This action required many farmers within the service area to immediately convert to gravity sprinkler systems. Advanced interagency planning and

close cooperation during construction resulted in a smooth transition to the new systems.

The 1993 *Southwestern Colorado Irrigation Guide* was published and widely distributed during the year. In addition to specific guidance for water management, the guide includes a calendar of agricultural events, instructions on how to read various water measuring devices, and other information.

Development of an automatic shutoff valve for sprinkler systems continued. To date, 18 valves have been installed by participants to help achieve irrigation water management. A demonstration project is underway using drip irrigation to show the effects of different irrigation water application rates on beans and wheat.

Glenwood-Dotsero Springs Unit, Colorado

This unit is located along the Colorado River in Eagle, Garfield, and Mesa Counties in west-central Colorado. The unit constitutes the second largest point source of salinity to the Colorado River. About half the salt comes from 20 surface saline springs; the remainder enters as seeps and underwater springs within the river channel.

Reclamation

Under a cooperative agreement with Reclamation, private developers are investigating the feasibility of privatizing salinity control of the saline springs in the vicinity of Glenwood Springs, Colorado. In 1993, the project sponsors developed a more locally acceptable desalination alternative.

Grand Valley Unit, Colorado

The Grand Valley Unit is located in west-central Colorado along the reach of the Colorado River near Grand Junction. The unit would remove the estimated 300,500 tons of salt added to the Colorado River annually as a result of conveyance system seepage and deep percolation from irrigated farmland.

Reclamation

Construction is underway on parts of the east end of the Government Highline Canal as well as the Price and Stubb Ditch systems. Reach 1b of the Government Highline Canal is under construction. Reach 1a will be awarded in fiscal year 94.

Work on the Mesa County Irrigation District and Palisades Irrigation District construction cooperative agreements for the Price and Stubb Ditch system improvements is about 40 percent complete with 29 of 70 miles of canal and lateral work completed. Work on these systems is expected to be completed in about 3 years. The Grand Valley Water Users have completed 11 of 60 miles of laterals. This cooperative agreement is scheduled to be completed in the next 4 to 5 years.

USDA

Implementation has been underway in this unit since 1979. In 1993, 65 new contracts were approved for a total of 3,329 CRSC contracts and Agricultural Conservation Program (ACP) salinity/long-term agreements since the program began. There are 123 applications pending approval.

The application of salinity control and wildlife habitat replacement practices continues. In this area, the salinity control program focuses on improving surface irrigation systems by installing underground pipelines, gated pipe, surge valves, concrete-lined ditches, and land leveling. Some conversion to drip and microjet irrigation systems is also taking place.

This is the final year for the surge demonstration and evaluation program being conducted with a grant from Reclamation. One hundred and thirty-five surge units have been installed by farmers under this program. Evaluation results show significant reductions in deep percolation after surge systems are installed and correctly operated. Since this demonstration program started, 240 additional surge systems have been installed by salinity control participants. A spinoff of the surge demonstration program is fertigation, which involves applying liquid nitrogen fertilizer during the soak stage of irrigation. Acceptance

of this practice is an additional incentive for farmers to install surge systems. A minimum tillage field demonstration was conducted on irrigated cropland to evaluate the effects on water quality, crop productivity, and farm economics. Monitored parameters included: water use, infiltration, deep percolation, surface runoff, and runoff water quality. The popular and informative monthly newsletter, *The Waterline*, continues to be published.

BLM

Efforts are underway to complete similar work already undertaken at Indian Wash drainage for those drainages west to the Utah State line. Objectives include improving grazing management practices, increasing vegetative cover, decreasing soil losses, and installing structures where needed to control flows and stop soil erosion.

Las Vegas Wash Unit, Nevada

Las Vegas Wash is a natural drainage channel that provides the only surface water outlet for the 2,000-square-mile Las Vegas Valley. A drainage area of 1,586 square miles directly contributes to the wash, which conveys storm runoff and wastewater to Las Vegas Bay, an arm of Lake Mead.

Reclamation

Reclamation continued quarterly monitoring of salinity at 15 sites in the Las Vegas Wash in 1993. Rapidly expanding population in the Las Vegas Valley appears to be a major contributor to increasing salt loads in the Las Vegas Wash. Annual documentation of results of the data collection effort are provided to the Forum. Completed portions of the unit prevent 3,800 tons of salt per year from reaching the Colorado River.

Lower Gunnison Basin Unit, Colorado

The Lower Gunnison Basin Unit is located in west-central Colorado in Delta and Montrose

Counties. The objective of the unit is to reduce salt loading by 414,500 tons per year in the Uncompahgre, Gunnison, and Colorado Rivers.

Reclamation

Winter water replacement system is about 80 percent complete with \$14 million having been spent through fiscal year 1993. A total of 120 miles out of 140 miles of pipe have been laid through 1993. Only 20 miles remain to be installed in 1994. About \$4 million of work remains to complete the winter water system. Most of the remaining work is being done by the Chipeta Water Company. They should be done by September 1994.

USDA

This is the largest of the USDA salinity control units in terms of total irrigated acres and the salt reduction goal. Implementation was initiated in 1988. During 1993, 77 new contracts were approved, for a total of 226 contracts. There are 411 applications pending approval.

The application of salinity reduction and wildlife habitat practices is rapidly increasing now that implementation is underway in all of the Lower Gunnison Basin Unit. The major salinity reduction practices being applied are underground pipelines, gated pipe, surge valves, ditch lining, land leveling, and irrigation water control structures to improve surface irrigation systems. Other practices include drip and microjet irrigation systems and some sprinkler systems.

This was the second year for the USDA/Reclamation surge irrigation demonstration project, with 80 farmers participating. Two special newspaper editions on the salinity control program were published, and 18 organizations and agencies cooperated to hold a 1-day "Water Festival" for 4th and 5th grade students in each county. Over 800 students attended this event, which will be held annually. Booths with information on the Salinity Program were set up at the county fair, and various field days and tours were held. On one of the field days, congressional representation from both the House and Senate were

present. The State representative for that district was also present and addressed the gathering.

Moapa Valley Unit, Nevada

This salinity control unit is located in the Muddy River watershed immediately upstream of the Overton arm from Lake Mead. Approximately 4,860 acres of land are irrigated in this area. The Muddy River contributes an average of about 56,500 tons of salt to Lake Mead annually.

USDA

The Moapa Valley final plan/environmental impact statement was issued in January 1993, and the Record of Decision (ROD) was published February 26, 1993. Many local meetings were held to discuss the various implementation actions.

The first salinity control contract in this unit was signed with the Muddy Valley Irrigation Company. This contract is for installation of the beginning segments of the irrigation water distribution system. A weather station has been installed and local climatological data is being recorded to determine irrigation water needs for crops in the Moapa Valley.

Paradox Valley Unit, Colorado

Reclamation

Reclamation's testing program at Paradox is designed to evaluate the feasibility of deep well injection as a method of brine (salt) disposal. The testing program is addressing three issues:

- Mechanical and operational costs.
- Chemical incompatibility.
- Injectivity of the receiving formation.

In 1993, Reclamation completed repairs identified in its shakedown testing of the facility in 1992, including mechanical and electrical

upgrades, acid stimulation of the well, injection of a freshwater buffer zone, and initial pump-in testing with brine.

Experience in operating the well has defined the costs. If the well can accept enough brine, the operation will be cost effective. Cost effectiveness is driven by costs and tons removed. The critical issue remaining to be resolved is the injectivity of the well. The costs are fairly well known, but without an estimate of how much brine (salt) can be injected, the cost effectiveness cannot be computed.

If testing of the receiving formation shows that the well can accept sufficient amounts of brine to be cost effective, a planning report will be prepared to evaluate alternatives and determine if the injection facility should be expanded to include pretreatment of the brine for sulfate removal or abandoned. Sulfate removal would eliminate chemical incompatibility problem.

Chemical incompatibility of the brine with the receiving formation was tested and confirmed by independent consultants. Sulfate removal, a relatively simple process, should be sufficient to eliminate this problem. This will be pursued only if injection testing demonstrates that the well will be reasonably cost effective.

If at any time during testing of the receiving formation, the test results show that well cannot accept sufficient amounts of brine to be cost effective, a planning report would be prepared to evaluate other alternatives for the unit, such as evaporation.

Pariette Draw

BLM

Water quality monitoring stations are beginning to yield data on salt and flows in Pariette Draw, located in eastern Utah. Improvements have been made in the upper branch to reduce sedimentation into Pariette Draw in the Vernal District.

Price-San Rafael Rivers Unit, Utah

East-central Utah's Price and San Rafael Rivers basins contribute an estimated 430,000 tons of salt to the Colorado River annually. Approximately 60 percent of this load is attributable to agriculture.

Reclamation/USDA

USDA and Reclamation have prepared a draft planning report and environmental impact statement (PR/EIS) for the Price-San Rafael Rivers Unit. During 1993, responses to comments on the USDA voluntary wildlife habitat replacement program were made, and the final report is now being prepared.

Sagers Wash

BLM

The Greater Sagers Wash Watershed Management Plan was approved in February 1993. The purpose of the effort is to reduce annual sediment and salt yield to the Colorado River at McGraw Bottom by 5,600 and 200 tons per year, respectively.

Following public involvement and environmental assessments, implementation of the plan begins in fiscal year 1994. During fiscal year 1994, BLM expects to undertake two demonstration projects.

Paired watersheds continue yielding water quality monitoring data at two stations, which are largely supported by cooperative funding from the Upper Colorado Region, Bureau of Reclamation. Complete data reports for water years 1991 and 1992 have been submitted to Reclamation.

San Juan River Unit, New Mexico

The study area includes the entire 23,000-square-mile San Juan River watershed from the river's headwaters in south-central Colorado to its mouth at Lake Powell. The drainage contributes approximately 1 million tons of salt annually to the Colorado

River system. The Hammond Project and the Hogback Irrigation Project are the principal irrigation-induced sources of salt loading in the basin.

Reclamation

Reclamation proposes to reduce seepage losses to the main canal system by lining the canal with either concrete or membrane linings. These improvements would eliminate seepage into the saline formations beneath the canals, thus reducing salinity. Reclamation is preparing an environmental assessment for the Hammond area; a draft is scheduled for completion in January 1994. The unit, one of the most cost-effective units in the program, would reduce salt loading by an estimated 27,700 tons per year.

Reclamation has received reports of and observed saline inflows to the San Juan River in the "Hogback" area. Hundreds of oil and gas exploration wells have been drilled in this area, raising concerns over mobilization of saline aquifers. Reclamation is investigating the apparent salt gains along the San Juan River.

USDA

A salinity investigation was completed by Arizona SCS on irrigated lands along the San Juan River in New Mexico from the vicinity of Fruitland, westward to Cudei. This area, consists of about 8,400 irrigated acres within the boundaries of the Navajo Nation. The investigation concluded that a reduction in salt loading of approximately 36,000 tons of salt per year could be accomplished by improving the onfarm irrigation systems, increasing the level of irrigation water management, and lining and repairing canals and laterals. Findings from the investigation were published in a verification report.

BLM

BLM has continued to work with the State of New Mexico to acquire funds for orphaned well plugging and has also cooperated on the unlined pit closure/remediation efforts. The investigation of the hydrology and salinity of the Aneth Project area, begun in fiscal year 1991 continues.

Uinta Basin Unit, Utah

This unit is located in northeastern Utah. Seepage from conveyance systems and deep percolation, resulting from irrigation, dissolve salts from the soils and shales and convey the salts through the ground-water system to natural drainages and, ultimately, to the Colorado River. The Uinta Basin contributes an estimated 450,000 tons of salt to the Colorado River annually.

Reclamation

Reclamation has proposed this unit for construction, and the proposal has been sent to the Department of the Interior for review. Under the preferred plan, canals and laterals would be lined to reduce seepage losses and the associated salt pickup. The Department of the Interior has asked the Office of Management and Budget to comment on the budgetary impacts of the unit.

USDA

Implementation began in this unit in 1980. During 1993, 156 new contracts were approved for a total of 1,526 CRSC contracts and ACP salinity/long-term agreements since the program began. There are 345 applications pending approval.

The rate of applying salinity reduction and wildlife habitat replacement practices continues to increase. The major practices being installed are sprinkler systems, improved surface systems, underground pipelines, and gated pipe. In this area, a large number of groups are replacing earthen laterals with pipelines to provide gravity pressure for onfarm sprinkler systems.

A demonstration plot is being established on Ute Indian Tribal land to illustrate the benefits of sprinkler irrigation; teach the principles of irrigation scheduling; and provide data on crop rotations, yields, and costs, and to determine fair market lease agreements. A sprinkler irrigation demonstration and field day was conducted for the Ute Indian Tribe during the year. Throughout the unit, special emphasis is being placed on

working with individual farmers on the principles of irrigation water management.

In August, a special field review of the wildlife habitat replacement activities was conducted to address wildlife habitat replacement concerns, including the tracking system. Representatives from EPA, FWS, ASCS, Cooperative Extension Service, SCS, and the Colorado River Basin Salinity Control Forum attended. An action plan has been prepared to address the concerns identified in the field review.

Other Activities

USDA

USDA Agricultural Research Service continues to provide valuable salinity research. Research is conducted at the Snake River Conservation Center in Kimberly, Idaho; the U.S. Salinity Laboratory in Riverside, California; and in Fort Collins, Colorado.

USDA monitoring and evaluation (M&E) activities are underway in the Grand Valley, Uinta Basin, Big Sandy River, Lower Gunnison Basin, McElmo Creek, and Moapa Valley Units. As part of these activities, USDA is monitoring the effects of the salinity control program on salt load reductions, monitoring the economic impacts, and tracking the effects on wildlife habitat. M&E activities have been conducted for about 8 years in the Grand Valley and Uinta Basin. An annual report is prepared for each unit to provide information on the monitoring and evaluation activities. These reports contain the detailed information obtained from specific sites which are being monitored to determine the effects of implementation on salt loading and wildlife habitat. Special efforts continue on refinement of the methods to monitor and track implementation effects on wetlands and other wildlife habitat.

A USDA salinity control program video was completed in 1993. It included footage from each of the salinity control units and interviews with farmers who are participating in the program. The video was widely distributed to various agencies and organizations. Copies were provided to USDA offices in each salinity unit and to the Forum and Forum Work Group.

The USDA National Salinity Control Coordinating Committee prepared the 1993 *Report to Congress*. This 5-year report was submitted to Congress as required by the Colorado River Basin Salinity Control Act of 1974, as amended. It provides information on the program objectives, scope, and implementation impacts.

Work is underway on various items in the SCS/EPA wetland salinity action plan.

BLM

The BLM Assistant Director and agency soil and water specialists, together with the BLM salinity manager, other agency salinity coordinators, and the Forum's Executive Director met in April 1991 to discuss accomplishments and future activities. Based upon a strategy developed at the 1991 Grand Junction meeting, the BLM Director issued on May 31, 1991, a Colorado River salinity control strategy.

Salinity control decisions made by BLM are subject to a consistency test with the above strategy. The agency uses a land management planning process as the internal vehicle for carrying forward solutions to salinity problems, with consideration for all resource values.

All rangeland watersheds in the Basin will be ranked consistently using expertise and experience of many organizations, and priorities will be established based upon the rankings. The determination of cost effectiveness in BLM comprehensive salinity control plans will be conducted consistent with Bureau of Reclamation and U.S. Department of Agriculture procedures.

Monitoring will be conducted efficiently and effectively to evaluate progress in reaching salt reduction objectives.

An interagency watershed ranking effort is well underway in Wyoming, involving many organizations and agencies. High priority watersheds are being identified for followup action.

Reclamation

Colorado River Simulation System Support.—Colorado River Simulation System (CRSS) is used extensively by Reclamation to forecast salinity conditions and evaluate compliance with the water quality (salinity) standards. To do this, accurate water use data is needed as a base for these predictions. Preparing base maps for a remote sensing program to refine current water use estimates in the upper Colorado River Basin are among the activities that support CRSS.

Lower Gunnison Basin Unit, Colorado.—

Reclamation completed a study evaluating alternatives to reduce the cost of the canal and lateral lining. The study found construction costs could be significantly reduced by eliminating the canal lining program, by combining and piping the laterals, and by the continued use of construction cooperative agreements with the water districts. Reclamation has been working on a preconstruction report.

Non-point Source Control, Utah.—Reclamation began working in cooperation with the BLM to evaluate the effectiveness of various rangeland management techniques for erosion and salinity control as an outcome of the Non-point Source Control Screening Studies in Utah and Colorado. In 1993, the monitoring program was up and fully operational in the Castle Peak and Sagers Wash study areas.

North Desert Study.—In Colorado, Reclamation and BLM have scoped plans to jointly evaluate the effectiveness of grazing management to improve soil and salinity conditions in the Grand Junction area. In 1993, a cooperative agreement for the study was drafted and monitoring plans developed to use each agency's expertise.

Price-San Rafael Rivers Unit, Utah.—The USDA and Reclamation prepared a combined Reclamation/SCS draft PR/EIS evaluating a comprehensive salinity control program for

agriculture in these two basins. During 1993, Reclamation assisted in developing responses to the draft PR/EIS raised during this review. The final report is being revised to reflect new salinity benefit estimates and should be complete early in 1994.

Surge Irrigation Demonstration, Utah and Colorado.—Reclamation and agencies of the USDA developed a program to demonstrate

efficient irrigation technologies to farmers as part of the salinity control program. Due to its outstanding success in the Grand Valley, Reclamation has moved its program into two new areas. In 1992, the program was expanded into the Lower Gunnison Basin in Colorado, and in 1993, into the Price and San Rafael Basins in Utah.

Appendix - Repayment Analysis

The Lower Colorado River Basin repayment spreadsheets provide a comparison of estimates between the net revenues from the Lower Colorado River Basin Development (LCRBD) Fund and Lower Colorado River Basin States (Arizona, California, and Nevada) share of reimbursable costs for salinity control projects. The reimbursable costs to the States are based on capital and operation and maintenance (O&M) costs spent as of 1992, budgeted costs (capital and O&M) for 1993 and 1994, and projected costs from 1995 to 2015. Projected cost estimates from 1995 to 2015 are based on the full implementation of the Salinity Program to meet the salinity target level in 2015. The repayment spreadsheets assist program managers in developing an implementation plan of salinity projects that meet the salinity numeric criteria at the three stations on the Colorado River (Hoover Dam, Parker Dam, and Imperial Dam).

Projects in the implementation plan are either completed or in various stages of planning and construction. Cost estimates for projects being planned or constructed are in "1992" dollars. Cost estimates for the projects are on record in the Bureau of Reclamation (Reclamation) and the Soil Conservation Service offices.

The reimbursable portion of these projects to the Lower Colorado River Basin States is based on two repayment formulas determined by Public Law 93-320 and Public Law 98-569.

Reclamation projects authorized under Public Law 93-320 are Grand Valley Stage One, Grand Valley Stage Two, Las Vegas Wash, and Paradox Valley. The repayment formula that is applied after project construction is completed, states that 25 percent of the total construction cost is reimbursable without interest by Basin States. Eighty-five percent of this reimbursable portion is to be paid by the Lower Colorado River Basin States over a 50-year period. The repayment formula applied in the spreadsheet is (total construction costs \times 0.25 \times 0.85)/50 years.

Repayment of O&M costs uses a similar formula (annual O&M costs \times 0.25 \times 0.85), where

repayment is made in the next year after the year in which the costs are incurred.

The repayment formula authorized under Public Law 98-569 provides that 30 percent of the costs of construction and O&M cost is reimbursable, 85 percent of which is reimbursable by the Lower Colorado River Basin States. This law requires that the reimbursable cost to the Lower Basin States be repaid either without interest during the year the costs are incurred, or, if the LCRBD Fund is unable to repay during the year costs are incurred, interest is charged on the unpaid portion of that year. The repayment formula applied to the spreadsheet is: annual projects costs (capital and O&M) \times 0.30 \times 0.85. Projects covered by this repayment formula are: Grand Valley Unit (USDA), Uinta Basin (USDA), Lower Gunnison Basin (USDA), Lower Gunnison Basin Unit—Winter Water (USBR), Lower Gunnison—Laterals (USBR), Dolores Project (salinity control portion), McElmo Creek (USDA), Big Sandy (USDA), Moapa Valley (USDA), Price-San Rafael (USDA), Price-San Rafael (USBR), Hammond (USBR), and Uinta Stage I (USBR).

Major changes from the 1991 Joint Evaluation Report (JER) repayment analysis are as follows:

1. In the spreadsheet, dollar estimates under the column titled, "Total Investment Costs" represent the construction and O&M (Reclamation projects only) costs for each project.
2. Period of analysis is extended from the year 2010 to the year 2015. This increases the O&M costs (approximately \$4.3 million) for some projects in the program.
3. Changes in project schedules, construction costs, and O&M costs made to the repayment spreadsheet for the following projects are:
 - a. Glenwood-Dotsero Springs Unit eliminated from the Salinity

Program. Reduction in total O&M costs by approximately \$105 million.

- b. Paradox Valley—Construction of evaporation ponds are included in the total costs of the project. Additional construction costs are approximately \$26.9 million.
- c. The addition of Reclamation's Lower Gunnison—Laterals Project to the program. This increases program costs approximately \$47 million (\$45.0 million for construction costs and \$1.8 million for O&M costs).
- d. Price-San Rafael (USDA) unit construction has been rescheduled to begin in the year 2009. The total costs covered during the 2009 to 2015 period is approximately \$15.3 million. This is approximately a \$7.0-million-dollar reduction in program costs for this time period. Price-San Rafael (USBR) construction is also rescheduled for the same period (2009 to 2015). This change results in a reduction in total costs of \$17.5 million.
- e. San Juan (USDA) project is eliminated from the project. This reduces program costs by approximately \$2.2 million.
- f. Construction costs for Grand Valley Stage II is reduced by approximately \$5.5 million.
- g. Uinta Basin (USDA) project costs increased by approximately \$4.9 million.

Various projects also have some smaller construction cost increases. There are additional costs due to indexing project costs from October 1990 dollars to October 1992 dollars. The net impact on project construction costs is an increase of approximately \$59.9 million. The net impact on changes to O&M costs is a decrease of approximately \$99 million.

- 4. There is also a significant increase in the dollars spent on salinity control projects from 1990 to 1992. Dollars spent to date are deducted from the total costs of the Salinity Program to derive the estimated cost of the current Salinity Program. The increase in dollars spent between 1990 and 1992 is approximately \$84.2 million.

The effect of all these changes (expressed in millions of dollars) to the 1991 JER repayment spreadsheet is summarized below:

Estimated remaining costs in 1991 JER repayment spreadsheet: \$603.86.

- 1. Net change in current project construction costs: +\$59.94.
- 2. Net change in O&M costs: -\$99.163.
- 3. Net change in dollars spent from 1990 to 1992: -\$84.19.

Estimated remaining costs in 1993 JER repayment spreadsheet: \$480.45.

Repayment spreadsheet No. 1 contains the Lower Colorado River Basin Development (LCRBD) Fund balance of \$18,795,000 as of 1992. From 1993 to 1997, projected revenues have been revised downward from the 1991 JER annual revenue projection of \$9.1 million to approximately \$8.3 million. From 1998 to 2010, projected annual revenues have been revised upward from \$9.1 million to \$9.2 million, and this estimate is projected to 2015. Estimated annual repayment costs for the Lower Colorado River Basin States are deducted from the LCRBD Fund from 1993 to 2015. For those years in which the repayment costs are greater than the balance in the LCRBD Fund, there is a deficit in the Fund, and interest on that deficit is calculated and added to the deficit amount. The deficit balance is then added to the next year's repayment costs. The 7.375-percent interest rate used to calculate any interest charges is the rate applicable for fiscal year 1993 and is to be applied on repayment of projects under the Colorado River Basin Salinity Control Act. The projected balance in the LCRBD Fund for the year 2015 is \$116.1 million.

Repayment spreadsheet No. 2 includes the application of an inflation rate to the remaining project costs in spreadsheet No. 1. This spreadsheet determines the inflation rate required to bring the LCRBD Fund to a zero balance by the year 2015. After a series of

calculations using different inflation rates, a zero balance in the fund is reached by using an annual inflation rate of approximately 6.4 percent. Based on this annual inflation rate, the estimated remaining (after 1992) salinity control program cost is \$962 million.

Spreadsheet #1

Spreadsheet#2

76	B	C	D	E	F	G	H	I	J	K	L	M	N
77	Repayment Analysis - 1993 JER	\$962 Million Alter. With Inflation @ 0.06396											
78	\$ in 1,000's	Total Investment Costs	O&M Costs	Total thru									
81	P.L.93-320 Units			1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
83	Grand Valley Stage I	29,466	421	29,045	9	9	10	10	11	12	12	13	14
84	Grand Valley Stage II	174,335	11,951	78,379	17,988	17,483	13,911	15,664	10,014	8,944	409	435	463
85	Las Vegas Wash - Pittman -	4,356	2,630	1,727	53	57	60	64	68	73	77	82	87
86	Paradox Valley Unit	132,900	14,026	59,339	4,099	4,480	1,807	7,689	8,180	8,704	9,260	9,852	812
87													
88	Subtotal P.L.93-320 Units:	341,057	29,028	168,490	22,149	22,029	15,787	23,427	18,274	17,732	9,759	10,383	1,377
89	Cumulative Subtotal:			168,490	190,639	212,668	228,455	251,882	270,156	287,888	297,647	308,030	309,406
90													
91	LCRB State's Costs												
92	Grand Valley Stage I				125	125	125	126	126	126	126	126	126
93	Grand Valley Stage II				19	19	19	20	21	22	23	24	25
94	Las Vegas Wash - Pittman -												
95	Paradox Valley Unit												505
96													
97	Subtotal - LCRB State's Costs			0	144	144	145	146	147	148	839	927	1,439
98													
99	P.L.98-569 Units												
100													
101	Grand Valley USDA	63,895	0	18,400	1,511	1,607	1,927	1,922	2,045	2,176	2,315	2,463	2,621
102	Uinta Basin USDA	109,804	0	26,400	2,958	3,170	3,131	3,332	3,545	3,772	4,013	4,105	4,368
103	Lower Gunnison Basin USDA	272,039	0	5,900	2,490	2,943	3,252	3,460	3,681	4,207	5,093	5,911	7,163
104	Lower Gunnison Wntr Wtr USBR	40,854	12,632	13,945	3,867	4,746	437	465	495	527	560	596	634
105	Lower Gunnison-Laterals USBR	81,951	64,204	0	0	0	4,818	5,126	5,454	5,802	6,173	6,568	6,988
106	Dolores-Salinity Conti-USBR	43,580	2,636	17,925	10,025	9,442	2,726	90	96	102	109	116	123
107	McElmo Creek USDA	27,974	0	2,200	755	1,019	964	1,025	1,091	1,160	1,235	1,314	1,398
108	Big Sandy River USDA	12,923	0	2,800	851	1,019	964	1,025	1,091	1,160	1,235	1,149	874
109	Moapa Valley USDA	10,491	0	0	0	679	1,204	1,281	1,363	1,160	617	493	524
110	Price-San Rafael USDA	50,477	0	0	0	0	0	0	0	0	0	0	0
111	Pnce-San Rafael USBR	64,330	0	0	0	0	0	0	0	0	0	0	0
112	Hammond - USBR	31,600	1,075	0	0	0	0	0	0	0	0	0	0
113	Uinta Stage I USBR	66,588	10,237	0	0	0	0	0	0	0	0	1,642	5,241
114													
115													
116	Subtotal P.L.98-569 Units	876,507	90,784	87,570	22,457	24,626	19,422	17,727	18,860	20,067	21,350	24,358	29,934
117	Cumulative Subtotal:			87,570	110,027	134,653	154,075	171,801	190,662	210,729	232,079	256,436	286,370
118													
119	Subtotal - LCRB State's Costs				5,727	6,280	4,953	4,520	4,809	5,117	5,444	6,211	7,633
120													
121	TOTAL - ALL UNITS	1,217,564	119,812	256,060	44,606	46,654	35,210	41,154	37,134	37,799	31,109	34,741	31,311
122	CUMULATIVE TOTAL:			256,060	300,666	347,321	382,530	423,684	460,818	498,617	529,725	564,466	595,776
123	Est. Remaining Program (w/infl)	961,504	1,217,564		256,060								
124													
125	TOTAL - LCRB State's Costs			0	5,870	6,424	5,098	4,666	4,956	5,265	6,283	7,138	9,072
126													
127	LCRB Funds			0	6,815	6,523	6,781	6,832	6,748	7,690	8,493	9,223	9,223
128	Balance			0	945	100	1,683	2,166	1,792	2,426	2,210	2,085	151
129	Previous Balance			0	18,795	19,739	19,839	21,522	23,688	25,480	27,906	30,116	32,201
130													
131	Balance			0	19,739	19,839	21,522	23,688	25,480	27,906	30,116	32,201	32,352
132	Interest Component			0	0	0	0	0	0	0	0	0	0
133													
134	TOTAL - Balance			18,795	19,739	19,839	21,522	23,688	25,480	27,906	30,116	32,201	32,352
135													
136	LCRB FUND CALCULATIONS												
137													
138	HOOVER Revenues				8,348	8,056	8,313	8,365	8,281	9,223	9,223	9,223	9,223
139	PARKER-DAVIS Revenues				0	0	0	0	0	0	0	0	0
140	MINUS HOOVER DEFIC				1,533	1,533	1,533	1,533	1,533	1,533	730	0	0
141													
142	TOTAL FUNDS AVAILABLE				6,815	6,523	6,781	6,832	6,748	7,690	8,493	9,223	9,223
143	AS OF 1992:												
144	LCRBD Fund Revenues =	43,920											
145	- Hoover Deficiency pmts	17,664											
146	- Salinity Repayments	7,461											
147	Fund Balance	18,795											

2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
15	16	17	18	19	20	22	23	24	26	28	29	31	33
493	524	558	593	631	672	715	760	809	861	916	974	1,037	1,103
93	99	105	112	119	127	135	143	153	162	173	184	196	208
864	920	978	1,041	1,108	1,178	1,254	1,334	1,419	1,510	1,607	1,709	1,819	1,935
1,465	1,558	1,658	1,764	1,877	1,997	2,125	2,261	2,405	2,559	2,723	2,897	3,082	3,279
310,871	312,430	314,088	315,852	317,729	319,726	321,851	324,111	326,517	329,076	331,799	334,696	337,778	341,057
127	127	127	127	127	128	128	128	129	129	129	130	130	131
789	795	802	809	816	824	833	842	852	862	873	885	897	910
26	27	28	30	31	33	34	36	38	40	42	44	46	49
678	689	701	713	726	741	756	772	789	807	826	847	868	892
1,619	1,638	1,658	1,679	1,701	1,725	1,751	1,778	1,807	1,838	1,870	1,905	1,942	1,982
2,788	2,967	3,156	3,358	3,573	3,041	2,696	1,779	1,892	1,656	0	0	0	0
4,647	4,944	6,313	6,716	7,146	7,096	7,550	6,598	0	0	0	0	0	0
7,621	8,109	7,996	8,507	9,766	12,165	16,718	20,369	22,557	21,759	22,805	23,896	24,446	21,224
675	718	764	813	865	920	979	1,041	1,108	1,179	1,254	1,334	1,420	1,511
7,435	7,911	8,417	8,955	2,382	507	539	574	610	650	691	735	782	832
131	139	148	158	168	178	190	202	215	229	243	259	275	293
1,487	1,582	1,683	1,791	1,906	2,027	2,157	2,295	885	0	0	0	0	0
558	198	0	0	0	0	0	0	0	0	0	0	0	0
558	593	631	672	715	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	3,730	3,968	6,495	6,911	9,191	9,779	10,404
0	0	0	0	0	0	0	2,869	6,105	9,743	10,366	11,029	11,734	12,485
0	0	0	2,239	7,146	7,603	8,089	5,448	153	162	173	184	196	208
5,577	5,933	6,313	6,716	7,146	7,603	8,089	5,738	3,306	578	615	654	696	741
31,477	33,094	35,421	39,925	40,812	41,141	47,008	50,643	40,799	42,451	43,058	47,282	49,329	47,698
317,847	350,941	386,362	426,287	467,099	508,240	555,248	605,891	646,690	689,140	732,198	779,481	828,809	876,507
8,027	8,439	9,032	10,181	10,407	10,491	11,987	12,914	10,404	10,825	10,980	12,057	12,579	12,163
32,941	34,653	37,079	41,690	42,689	43,138	49,133	52,903	43,204	45,010	45,781	50,179	52,411	50,977
628,718	663,370	700,450	742,139	784,828	827,966	877,099	930,002	973,207	1,018,216	1,063,997	1,114,176	1,166,587	1,217,564
9,645	10,077	10,690	11,860	12,108	12,216	13,738	14,692	12,211	12,662	12,850	13,962	14,521	14,144
9,223	9,223	9,223	9,223	9,223	9,779	10,891	10,891	10,891	10,891	10,891	10,891	10,891	10,891
(422)	(853)	(1,467)	(2,637)	(2,885)	(2,437)	(2,847)	(3,801)	(1,319)	(1,771)	(1,959)	(3,071)	(3,630)	(3,253)
32,352	31,929	31,076	29,609	26,973	24,088	21,651	18,804	15,004	13,684	11,913	9,954	6,883	3,253
31,929	31,076	29,609	26,973	24,088	21,651	18,804	15,004	13,684	11,913	9,954	6,883	3,253	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
31,929	31,076	29,609	26,973	24,088	21,651	18,804	15,004	13,684	11,913	9,954	6,883	3,253	0
9,223	9,223	9,223	9,223	9,223	9,223	9,223	9,223	9,223	9,223	9,223	9,223	9,223	9,223
0	0	0	0	0	0	556	1,668	1,668	1,668	1,668	1,668	1,668	1,668
0	0	0	0	0	0	0	0	0	0	0	0	0	0
9,223	9,223	9,223	9,223	9,223	9,779	10,891	10,891	10,891	10,891	10,891	10,891	10,891	10,891

Spreadsheet #3

A1 Repayment Analysis for 1993 Joint Evaluation Report 2 Colorado River Salinity Program Hoover				May 20, 1993 Defc. Payment Analysis				\$480 Million Alternative - Without Inflation								
4	5	6	7	Total Investment Costs	O&M Costs	Total thru 1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	
				P.L.93-320 Units												
8	Grand Valley Stage I	29,229	184	29,045	8	8	8	8	8	8	8	8	8	8	8	
9	Grand Valley Stage II	152,520	4,505	78,379	16,907	15,444	11,550	12,224	7,345	6,166	265	265	265	265	265	
10	Las Vegas Wash-Pittman	2,877	1,150	1,727	50	50	50	50	50	50	50	50	50	50	50	
11	Paradox Valley Unit	105,625	6,975	59,339	3,853	3,958	1,500	6,000	6,000	6,000	6,000	6,000	6,000	6,000	465	
12																
13	Subtotal P.L.93-320 Units:	290,251	12,814	168,490	20,818	19,460	13,108	18,282	13,403	12,224	6,323	6,323	788			
14	Cumulative Subtotal:				168,490	189,308	208,768	221,876	240,158	253,561	265,785	272,108	278,431	279,219		
15																
16	LCRB State's Costs															
17	Grand Valley Stage I					125	125	125	125	125	125	125	125	125	125	
18	Grand Valley Stage II					18	18	18	18	18	18	18	18	18	18	
19	Las Vegas Wash-Pittman														419	
20	Paradox Valley Unit															
21																
22	Subtotal-LCRB State's Costs					143	143	143	143	143	143	772	828	1,248		
23																
24	P.L.98-569 Units															
25																
26	Grand Valley USDA	41,870	0	18,400	1,420	1,600	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	
27	Uinta Basin USDA	71,880	0	26,400	2,780	2,800	2,600	2,600	2,600	2,600	2,600	2,600	2,500	2,500	2,500	
28	Lower Gunnison Basin USDA	109,380	0	5,900	2,340	2,600	2,700	2,700	2,700	2,900	3,300	3,600	4,100			
29	Lower Gunnison-Wntr Wtr USBR	29,396	7,623	13,945	3,635	4,193	363	363	363	363	363	363	363	363	363	
30	Lower Gunnison-Laterals USBR	46,800	1,800	0	0	0	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	
31	Dobres-Salinity Contl USBR	39,359	1,408	17,925	9,422	8,341	2,263	70	70	70	70	70	70	70	70	
32	McElmo Creek USDA	16,100	0	2,200	710	900	800	800	800	800	800	800	800	800	800	
33	Big Sandy River USDA	10,100	0	2,800	800	900	800	800	800	800	800	800	800	800	500	
34	Moapa Valley USDA	6,900	0	0	0	600	1,000	1,000	1,000	1,000	800	400	300	300		
35	Price-San Rafael USDA	15,300	0	0	0	0	0	0	0	0	0	0	0	0	0	
36	Price-San Rafael USBR	18,000	0	0	0	0	0	0	0	0	0	0	0	0		
37	Hammond - USBR	12,199	300	0	0	0	0	0	0	0	0	0	0	0	0	
38	Uinta Stage I USBR	28,973	890	0	0	0	0	0	0	0	0	0	1,000	3,000		
39																
40																
41	Subtotal P.L.98-569 Units	446,257	12,021	87,570	21,107	21,934	16,026	13,833	13,833	13,833	13,833	13,833	14,833	17,133		
42	Cumulative Subtotal:			87,570	108,677	130,611	146,637	160,470	174,304	188,137	201,971	216,804	233,937			
43																
44	Subtotal - LCRB Costs					5,382	5,593	4,087	3,528	3,528	3,528	3,528	3,783	4,369		
45																
46	TOTAL - ALL UNITS	736,508	24,835	256,060	41,925	41,394	29,134	32,115	27,236	26,057	20,156	21,156	17,921			
47	CUMULATIVE TOTAL:			256,060	297,985	339,379	368,513	400,628	427,864	453,922	474,078	495,235	513,156			
48	Est. Remaining Program =			+												
49	\$480,448	736,508		256,060												
50	TOTAL - LCRB State's Costs				0	5,525	5,736	4,230	3,671	3,671	3,671	4,300	4,611	5,617		
51																
52	LCRB Funds (see below FUND CALCULATIONS)				0	6,815	6,523	6,781	6,832	6,748	7,690	7,690	7,690	7,690		
53	Balance				0	1,290	787	2,551	3,162	3,078	4,020	3,391	3,079	2,074		
54	Previous Balance				0	28,815	30,104	30,891	33,442	36,604	39,681	43,701	47,092	50,171		
55																
56	Balance				0	30,104	30,891	33,442	36,604	39,681	43,701	47,092	50,171	52,244		
57	Interest Component				0	0	0	0	0	0	0	0	0	0	0	
58																
59	TOTAL - Balance				28,815	30,104	30,891	33,442	36,604	39,681	43,701	47,092	50,171	52,244		
60																
61	LCRB FUND CALCULATIONS															
62																
63	HOOVER Revenues					8,348	8,056	8,313	8,365	8,281	9,223	9,223	9,223	9,223		
64	PARKER-DAVIS Revenues					0	0	0	0	0	0	0	0	0	0	
65	MINUS HOOVER DEFIC					1,533	1,533	1,533	1,533	1,533	1,533	1,533	1,533	1,533		
66																
67	TOTAL FUNDS AVAILABLE					6,815	6,523	6,781	6,832	6,748	7,690	7,690	7,690	7,690		
68	AS OF 1992															
69	LCRBD Fund Revenues =					43,920										
70	- Hoover Deficiency pmts					7,644										
71	- Salinity Repayments					7,461										
72	Fund Balance					28,815										

Spreadsheet #4

76 Hoover Deficiency	C	D	E	F	G	H	I	J	K	L	M	N
77 Repayment Analysis - 1993 JER	\$962 Million Alter. With Inflation @ 0.06396											
78	\$ in 1,000's	Total Investment Costs	O&M Costs	Total thru								
79	P.L. 93-320 Units			1992	1993	1994	1995	1996	1997	1998	1999	2000
80												2001
81	83 Grand Valley Stage I	29,466	421	29,045	9	9	10	10	11	12	12	13
82	84 Grand Valley Stage II	174,335	11,951	78,379	17,988	17,483	13,911	15,664	10,014	8,944	409	435
83	85 Las Vegas Wash - Pittman -	4,356	2,630	1,727	53	57	60	64	68	73	77	82
84	86 Paradox Valley Unit	132,900	14,026	59,339	4,099	4,480	1,807	7,689	8,180	8,704	9,260	9,852
85												812
86	88 Subtotal P.L. 93-320 Units:	341,057	29,028	168,490	22,149	22,029	15,787	23,427	18,274	17,732	9,759	10,383
87	89 Cumulative Subtotal:			168,490	190,639	212,668	228,455	251,882	270,156	287,888	297,647	308,030
88	90 LCRB State's Costs											
89	92 Grand Valley Stage I				125	125	125	126	126	126	126	126
90	93 Grand Valley Stage II				19	19	19	20	21	22	23	25
91	94 Las Vegas Wash - Pittman -											505
92	95 Paradox Valley Unit											
93	96 Subtotal - LCRB State's Costs			0	144	144	145	146	147	148	839	927
94	98 P.L. 98-569 Units											1,439
95												
96	101 Grand Valley USDA	63,895	0	18,400	1,511	1,607	1,927	1,922	2,045	2,176	2,315	2,463
97	102 Uinta Basin USDA	109,804	0	26,400	2,958	3,170	3,131	3,332	3,545	3,772	4,013	4,105
98	103 Lower Gunnison Basin USDA	272,039	0	5,900	2,490	2,943	3,252	3,460	3,681	4,207	5,093	5,911
99	104 Lower Gunnison Wntr Wtr USBR	40,854	12,632	13,945	3,867	4,746	437	465	495	527	560	634
100	105 Lower Gunnison-Laterals USBR	81,951	64,204	0	0	0	4,818	5,126	5,454	5,802	6,173	6,568
101	106 Dolores-Salinity Contd-USBR	43,580	2,636	17,925	10,025	9,442	2,726	90	96	102	109	116
102	107 McElmo Creek USDA	27,974	0	2,200	755	1,019	964	1,025	1,091	1,160	1,235	1,314
103	108 Big Sandy River USDA	12,923	0	2,800	851	1,019	964	1,025	1,091	1,160	1,235	1,149
104	109 Moapa Valley USDA	10,491	0	0	0	679	1,204	1,281	1,363	1,160	617	493
105	110 Price-San Rafael USDA	50,477	0	0	0	0	0	0	0	0	0	0
106	111 Price-San Rafael USBR	64,330	0	0	0	0	0	0	0	0	0	0
107	112 Hammond - USBR	31,600	1,075	0	0	0	0	0	0	0	0	0
108	113 Uinta Stage I USBR	66,588	10,237	0	0	0	0	0	0	0	0	1,642
109												5,241
110												
111	116 Subtotal P.L. 98-569 Units	876,507	90,784	87,570	22,457	24,626	19,422	17,727	18,860	20,067	21,350	24,358
112	117 Cumulative Subtotal:			87,570	110,027	134,653	154,075	171,801	190,662	210,729	232,079	256,436
113												286,370
114												
115	119 Subtotal - LCRB State's Costs				5,727	6,280	4,953	4,520	4,809	5,117	5,444	6,211
116	120 TOTAL - ALL UNITS	1,217,564	119,812	256,060	44,606	46,654	35,210	41,154	37,134	37,799	31,109	34,741
117	122 CUMULATIVE TOTAL:			256,060	300,666	347,321	382,530	423,684	460,818	498,617	529,725	564,466
118	123 Est. Remaining Program (w/infl)	-	-	-	-	-	-	-	-	-	-	595,776
119	124 961,504	1,217,564		256,060								
120	125 TOTAL - LCRB State's Costs			0	5,870	6,424	5,098	4,666	4,956	5,265	6,283	7,138
121	126 LCRB Funds			0	6,815	6,523	6,781	6,832	6,748	7,690	7,690	7,690
122	127 Balance			0	945	100	1,683	2,166	1,792	2,426	1,407	552
123	128 Previous Balance			0	28,795	29,739	29,839	31,522	33,688	35,480	37,906	39,313
124	129 0			0	29,739	29,839	31,522	33,688	35,480	37,906	39,313	39,865
125	130 0			0	0	0	0	0	0	0	0	0
126	131 Balance			0	29,739	29,839	31,522	33,688	35,480	37,906	39,313	39,865
127	132 Interest Component			0	0	0	0	0	0	0	0	0
128	133 28,795			28,795	29,739	29,839	31,522	33,688	35,480	37,906	39,313	39,865
129	134 TOTAL - Balance											38,483
130	135											
131	136 LCRB FUND CALCULATIONS											
132	138 HOOVER Revenues				8,348	8,056	8,313	8,365	8,281	9,223	9,223	9,223
133	139 PARKER-DAVIS Revenues				0	0	0	0	0	0	0	0
134	140 MINUS HOOVER DEFIC				1,533	1,533	1,533	1,533	1,533	1,533	1,533	1,533
135	141 1,533				6,815	6,523	6,781	6,832	6,748	7,690	7,690	7,690
136	142 TOTAL FUNDS AVAILABLE											
137	143 AS OF 1992											
138	144 LCRBD Fund Revenues =	43,920										
139	145 - Hoover Deficiency prnts	7,664										
140	146 - Salinity Repayments	7,461										
141	147 Fund Balance	28,795										

2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
15	16	17	18	19	20	22	23	24	26	28	29	31	33
493	524	558	593	631	672	715	760	809	861	916	974	1,037	1,103
93	99	105	112	119	127	135	143	153	162	173	184	196	208
864	920	978	1,041	1,108	1,178	1,254	1,334	1,419	1,510	1,607	1,709	1,819	1,935
1,465	1,558	1,658	1,764	1,877	1,997	2,125	2,261	2,405	2,559	2,723	2,897	3,082	3,279
310,871	312,430	314,088	315,852	317,729	319,726	321,851	324,111	326,517	329,076	331,799	334,696	337,778	341,057
127	127	127	127	127	128	128	128	129	129	129	130	130	131
789	795	802	809	816	824	833	842	852	862	873	885	897	910
26	27	28	30	31	33	34	36	38	40	42	44	46	49
678	689	701	713	726	741	756	772	789	807	826	847	868	892
1,619	1,638	1,658	1,679	1,701	1,725	1,751	1,778	1,807	1,838	1,870	1,905	1,942	1,982
2,788	2,967	3,156	3,358	3,573	3,041	2,696	1,779	1,892	1,656	0	0	0	0
4,647	4,944	6,313	6,716	7,146	7,096	7,550	6,598	0	0	0	0	0	0
7,621	8,109	7,996	8,507	9,766	12,165	16,718	20,369	22,557	21,759	22,805	23,896	24,446	21,224
675	718	764	813	865	920	979	1,041	1,108	1,179	1,254	1,334	1,420	1,511
7,435	7,911	8,417	8,955	2,382	507	539	574	610	650	691	735	782	832
131	139	148	158	168	178	190	202	215	229	243	259	275	293
1,487	1,582	1,683	1,791	1,906	2,027	2,157	2,295	885	0	0	0	0	0
558	198	0	0	0	0	0	0	0	0	0	0	0	0
558	593	631	672	715	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	3,730	3,968	6,495	6,911	9,191	9,779	10,404
0	0	0	0	0	0	0	2,869	6,105	9,743	10,366	11,029	11,734	12,485
0	0	0	2,239	7,146	7,603	8,089	5,448	153	162	173	184	196	208
5,577	5,933	6,313	6,716	7,146	7,603	8,089	5,738	3,306	578	615	654	696	741
31,477	33,094	35,421	39,925	40,812	41,141	47,008	50,643	40,799	42,451	43,058	47,282	49,329	47,698
317,847	350,941	386,362	426,287	467,099	508,240	555,248	605,891	646,690	689,140	732,198	779,481	828,809	876,507
8,027	8,439	9,032	10,181	10,407	10,491	11,987	12,914	10,404	10,825	10,980	12,057	12,579	12,163
32,941	34,653	37,079	41,690	42,689	43,138	49,133	52,903	43,204	45,010	45,781	50,179	52,411	50,977
628,718	663,370	700,450	742,139	784,828	827,966	877,099	930,002	973,207	1,018,216	1,063,997	1,114,176	1,166,587	1,217,564
9,645	10,077	10,690	11,860	12,108	12,216	13,738	14,692	12,211	12,662	12,850	13,962	14,521	14,144
7,690	7,690	7,690	7,690	9,223	9,779	10,891	10,891	10,891	10,891	10,891	10,891	10,891	10,891
(1,955)	(2,386)	(3,000)	(4,169)	(2,885)	(2,437)	(2,847)	(3,801)	(1,319)	(1,771)	(1,959)	(3,071)	(3,630)	(3,253)
38,483	36,528	34,142	31,142	26,973	24,088	21,651	18,804	15,004	13,684	11,913	9,954	6,883	3,253
36,528	34,142	31,142	26,973	24,088	21,651	18,804	15,004	13,684	11,913	9,954	6,883	3,253	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
36,528	34,142	31,142	26,973	24,088	21,651	18,804	15,004	13,684	11,913	9,954	6,883	3,253	0
9,223	9,223	9,223	9,223	9,223	9,223	9,223	9,223	9,223	9,223	9,223	9,223	9,223	9,223
0	0	0	0	0	556	1,668	1,668	1,668	1,668	1,668	1,668	1,668	1,668
1,533	1,533	1,533	1,533	0	0	0	0	0	0	0	0	0	0
7,690	7,690	7,690	7,690	9,223	9,779	10,891	10,891	10,891	10,891	10,891	10,891	10,891	10,891

